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# THE AMERICAN GENERA OF ASILIDAE (DIPTERA): KEYS FOR IDENTIFICATION WITH AN ATLAS OF FEMALE SPERMATHECAE AND OTHER MORPHOLOGICAL DETAILS. I. KEY TO SUBFAMILIES AND SUBFAMILY LEPTOGASTRINAE SCHINER[1]

# LOS GENEROS AMERICANOS DE ASILIDAE (DIPTERA): CLAVES PARA LA IDENTIFICACION CON UN ATLAS DE LAS ESPERMATECAS Y OTROS DETALLES MORFOLOGICOS. I. CLAVES PARA LAS SUBFAMILIAS Y SUBFAMILIA LEPTOGASTRINAE SCHINER

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ABSTRACT

Keys for the identification of the subfamilies of Asilidae and to the 9 American genera of the subfamily Leptogastrinae Schiner are presented, with illustrations of the male terminalia and spermathecae, as well as of other morphological details.

KEYWORDS: Asilidae, American genera, Keys, Spermathecae, Leptogastrinae.

RESUMEN

Se presentan claves para la identificación de las subfamilias de Asilidae y para los 9 géneros americanos de la subfamilia Leptogastrinae Schiner, con ilustraciones de la terminalia masculina y espermatecas, como de otros detalles morfológicos.

PALABRAS CLAVES: Asilidae, Géneros Americanos, Claves, Espermateca, Leptogastrinae.

## INTRODUCTION

The purpose of this series of papers is twofold: to provide an up to date key to the American genera of Asilidae and to illustrate the female spermathecae of the genera of which material was available to us in the collections studied.

No key existed before to the American genera of Asilidae. Carrera (1950) published a key to the Brazilian genera of Asilidae, now of course outdated, that included less than half the genera now known from the Neotropics. Artigas' (1970) monograph of the Chilean Asilidae still stands as a reference work, but is limited to a regional fauna. The only comprehensive key to the American genera was published by Hull (1962), is his review of the world genera of Asilidae, but his keys are very cumbersome to use and present many drawbacks. Many changes have happened since then in the taxonomy of this family in the Neotropics, and several new genera and new synonymies exist to be proposed. The necessity of bringing together all this information,

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allied to the preparation of a catalogue of the Neotropical species, now being undertaken for inclusion in the forthcoming "World Database of Flies", sponsored by the U.S. Department of Agriculture and U.S. National Museum of Natural History, prompted us to publish this series of keys, where we will try to define the American genera of Asilidae, proposing new synonymies and describing over twenty new genera.

A special effort has been made to illustrate one or more species of each genus, of which material was available, notably the female spermathecae, following the pioneer papers of Artigas (1971) and Theodor (1976, 1980). The spermathecae offer an entire new set of characters to be used in classification, unfortunately still little used by authors working with this family. In the keys we have only included a reference to the drawings, without describing the spermathecae because it is too early to say whether the form of these structures can characterize genera, as very few species of each genus have been dissected. In the publications of Theodor (notably that of 1980) one can verify that there is great variation in the form of the spermathecae within the same nominal genus - either there is indeed a variation, or the "genus" must be better studied and further subdivided. Anyway, dissection of the spermathecae bring many new and interesting characters to be used in the establishment of a classification, and in the future, in the establishment of a real systematization of the Asilidae.

## MATERIALS AND METHODS

The material used in this series belongs to the Museu de Zoologia de Universidade de São Paulo (MZUSP) and to the Departamento de Zoología, Facultad de Ciencias Biológicas y Recursos Naturales, Universidad de Concepción (MZUC).

The technique employed in the dissection and preservation of the male terminalia, female spermathecae and other morphological details is the same as Artigas (1971). The dissected specimens, with male terminalia in microvials, female spermathecae and other structures preserved in slides, are kept in the Museu de Zoologia da Universidade de São Paulo.

The external morphological terminology follows McAlpine (1981).

We have adopted here a classification of the Asilidae into 10 subfamilies, basically following that of Papavero (1973), with two modifications: the Leptogastrinae are included within the Asilidae, and the Stichopogonini have been granted subfamily status.

As commented upon by Wood (1981: 553-554), the Leptogastrinae "share with the rest of the Asilidae (several) synapomorphies (...), namely the modified proboscis and predatory behavior of the adult and the modifications of the larval maxilla and mandible (...). Some of the autapomorphic characters of the Leptogastrinae, such as absence of the alula and the pulvilli, absence of acanthophorites of the tenth abdominal segment of the female, and absence of larval mandibles, must be considered, in the context of other Asilomorpha and Tabanomorpha, to be derived characters shared with asilidae. Most other features of the Leptogastrinae such as their slender shape, their inclination to capture resting prey, their peculiar egg-laying habits, their helicopter-like flight, and their propensity to inhabit grassy habitats are autapomorphic; these features indicate only the distinctness of the Leptogastrinae as a group, not their phylogenetic position relative to other Asilidae or to the asilomorph families.

The Stichopogoninae are raised to subfamily status also because they share a number of autapomorphies: saddle-shaped head, whith widely divergent frons, absence of tentorial pits or grooves on the face, presence of a precoxal bridge formed by the fusion of the prosternum with the proepisternum, and the female terminalia with a characteristic ventral keel and spines at apex. They form a homogeneous and easily recognizable group.

The rank given to these groups is of course purely arbitrary, mostly designed to facilitate recognition, as we are still very far from understanding the phylogeny of the Asilidae. Until a real systematization of these flies is obtained, we must have recourse to these artificial classifications.

**Key to the subfamilies of Asilidae**
**(adapted from Papavero, 1973, and Wood, 1981)**

1. Abdominal tergite 1 five or more times as long as wide. Alula and pulvilli lacking. Abdominal sternite 1 extending about halfway back under tergite 2 ..... LEPTOGASTRINAE Schiner, 1862

Abdominal tergite 2 no more than four times as long as wide. Usually both alula and pulvilli present, but occasionally one or other absent. Abdominal sternite 1 confined beneath tergite 1 ..... 2

2(1). Fore tibia with an apical "spur", i. e., one of the spines at the apex of the ventral side of the fore tibia differentiated, enlarged and stouter than remaining spines, or if not noticeably larger, twisted and sigmoid. Prosternum dissociated by a membranous area from proepisternum (except in *Blepharepium* Rondani) ..... DASYPOGONINAE Macquart, 1838

Fore tibia without an apical "spur", i. e., all apical spines on fore tibia straight, or if one is slightly curved then it is not thickened or sigmoid. Prosternum either dissociated from proepisternum or fused to it ..... 3

3(2). Apex of $R_{2+3}$ directed sharply forward, meeting C at an angle of about 90°, ending either at distal end of $R_1$ (cell $r_1$ closed) or a short distance from $R_1$ along C (cell $r_1$ open). Vein $R_4$ strongly sinuate and arched forward after separation from $R_5$. Cells $m_3$ and cup always closed before wing margin. Prosternum fused to proepisternum. Male with only six abdominal tergites visible dorsally ..... LAPHYSTIINAE G. H. Hardy, 1948

Apex of $R_{2+3}$ not directed sharply forward before ending in C or $R_1$; $R_4$ not unusually arched and sinuate; cells $m_3$ and cup open to wing margin, or one of the two closed, or both closed. Prosternum dissociated from proepisternum or fused to it. Male with six to eight tergites visible dorsally ..... 4

4(3). $R_{2+3}$ ending in C (except in *Enigmomorphus* Hermann) and neither a strong bristle present on the supero-posterior angle of anepisternum nor a row of bristles present on the katatergite ..... 5

$R_{2+3}$ joining $R_1$ proximal to end of $R_1$, with cell $r_1$ thus separated from wing margin. Either anepisternum with at least one strong bristle on its supero-posterior angle, or katatergite with a vertical row of bristles or bristly hairs ..... 7

5(4). Prosternum dissociated from proepisternum by a membranous area ..... STENOPOGONINAE Hull, 1962

Prosternum fused to proepisternum, forming a precoxal bridge ..... 6

6(5). Frons narrowed at level of insertion of antennae and then suddenly and widely diverging towards apex, which is extremely shallow, i. e., eyes much more distant at vertex than at antennal level. Face without tentorial pits or grooves, flat above and prominent below or very gibbose. Posterodorsal corner of metepimeron bare. Abdomen slender. Female terminalia with characteristic ventral keel and spines ..... STICHOPOGONINAE G. H. Hardy, 1930

Frons approximately of same width at level of antennal insertion and vertex, the latter excavated; i. e., eyes not noticeably more distant at vertex than at antennal level. Face with pronounced tentorial pits or grooves extending well above lower facial margin. Face in profile not produced beyond eye margin. Posterolateral corners of metepimeron with short hairs. Abdomen very short, usually three-quarters or less width of wing. Female terminalia simple, tubular, without spines ..... TRIGONOMIMINAE Enderlein, 1914

7(5). Supero-posterior angle of anepisternum, in front of wing insertion, with at least one strong, long bristle and katatergite never with vertical row of bristles.

Prosternum fused to proepisternum. Palpus, one or two segmented. Female terminalia without spines ..... LAPHRIINAE Macquart, 1838

Supero-posterior angle of anepisternum never with a strong, long bristle and katatergite with a vertical row of long bristles or bristly hairs (rarely reduced to only one bristle). Prosternum dissociated from proepisternum or fused to it. Palpus always one-segmented. Female terminalia with or without spines..... 8

8(7). Anatergite bare, or if with some hairs, these placed mostly on latero-internal margin of anatergite and on immediately adjacent area of mediotergite, but never *on top* of anatergite and $R_4$, in this case, always with a short extra vein present at its juntion with $R_5$, the short vein ending in cell $r_{2+3}$ ..... 9

Anatergite pilose, the hairs situated *on top* of it and $R_4$ never with such an extra vein ..... ASILINAE Leach, 1819

9(8). Antennal stylus plumose. Postmetacoxal area heavily sclerotized, forming a complete bridge behind hind coxae ..... OMMATIINAE G. H. Hardy, 1927

Antennal stylus bare. Postmetacoxal area membranous..... APOCLEINAE Lehr, 1969

## Subfamily LEPTOGASTRINAE Schiner

Leptogastrinen Schiner, 1862: xxxviii (footnote).

### Key to the American genera

1. Anal angle of wing absent, CuA unbranched and $A_1$ absent (Fig. 1). Halter as long as mesonotum ..... 2

Anal angle of wing reduced but not absent. CuA branched to form $CuA_1$ and $CuA_2$, and $A_1$ present (Figs. 7, 21, 41). Halter much shorter than mesonotum 3

2(1). Basal half of wing reduced to a remarkably slender, hairlike stalk, bearing a few, fine cilia on each side. Discoidal cell absent, M with only two branches. Empodium well developed (Central America) ..... **Eurhabdus* Aldrich, 1923

Basal half of wing not as above, discoidal cell present and M three-branched (Fig. 1). Empodium reduced to half length of claws on first four legs, a little longer and stouter on hind legs (Fig. 3). Spermathecae as in Figs. 4-5 (USA to Argentina). ..... *Leptopteromyia* Williston, 1907

3(1). Claws unequal in length and empodium lacking (Fig. 6). Radial and medial veins, on both sides, with regularly spaced, long, conspicuous setae (Fig. 7). Flagellum laterally compressed and attenuate basally, ist dorsal apex with a short or long style or bristle (Fig. 8). Spermathecae as in Figs. 9-10 (Neotropical) ..... *Schildia* Aldrich, 1923

Claws of same length (Fig. 11); empodium present (sometimes claw-like) or absent. Radial and medial veins with only the usual dense, minute micropubescense. Flagellum sometimes a little narrowed at base, but attenuate distally, the style well developed ..... 4

4(3). Wing with diffuse spots or bands. Hind femur gradually swollen from the base, bearing more or less dense pile on all surfaces, subappressed laterally, erect elsewhere (Fig. 12). Male terminalia and aedeagus as in Figs. 13-17. Spermathecae as in Figs. 18-19 (Brazil)..... *Systellogaster* Hermann, 1914

Wing hyaline, never with spots or bands. Hind femur not as above ..... 5

(*) Material not available for dissections.

5(4). Middle of abdominal tergite 2 with a transverse band of long hairs (Fig. 20). Base of $M_2$ closing discoidal cell short, not more than 1.5 times length of crossvein m-m; crossvein m-cu present but short, or $M_3$ and $CuA_1$ narrowly united with each other, the union shorter than length of crossvein r-m (Fig. 21) ..... 6

Abdominal tergite 2 without transverse band of hairs at middle. Base of $M_2$ long, twice or more length of crossvein m-m; crossvein m-cu absent; $M_3$ and $CuA_1$ broadly united, the union longer than length of crossvein r-m (Fig. 41)..... 7

6(5). Width of face, at narrowest point, no wider than diameter of an adjacent eye facet (Fig. 22). Empodium lacking (Fig. 24). Epandrial lobe of male deeply divided, almost to base, forming narrow dorsal and wider ventral lobes (Figs. 25-27). Aedeagus as in Fig. 28. Spermathecae as in Figs. 29-32 (Americas)..... ..... *Psilonyx* Aldrich, 1923

Width of face, at narrowest point, 1.5-3.0 times as wide as diameter of an adjacent eye facet (Fig. 33). Empodium usually present. Epandrial lobe of male at most shallowly notched (Figs. 35-37). Spermathecae as in Figs. 38-40 (Americas) .... ..... *Beameromyia* Martin, 1957

7(6). Hind femur with distal swelling arising gradually, beginning at or before mid length. Scutellar margin with bristles or with hairs on disc as long as crossvein r-m. Epandrial lobe of male deeply divided almost to base, with ventral branch subequal in length to and narrower than dorsal branch (USA, Mexico, Bahamas, Jamaica) ..... **Apachekolos* Martin, 1957

Hind femur with distal swelling arising at about twothirds or more distance from the base (Fig. 43). Scutellar margin and disc bare or with a few small hairs. Epandrial lobe of male undivided, or, if divided, with the ventral branch longer and wider than the dorsal lobe *(Leptogaster)* or with both branches of equal length .. ..... *(Tipulogaster)* 8

8(7). Flagellum 2.5 times or more as long as the combined length of scape and pedicel and one-sixth as wide as long (Fig. 44). Male terminalia and aedeagus as in Figs. 46-50. Spermathecae as in Figs. 51-52 (Americas).. *Tipulogaster* Cockerell, 1913

Flagellum not more than twice as long as combined length of scape and pedicel and one-quarter as wide as long (Fig. 45). Male terminalia and aedeagus as in Figs. 53-57. Spermathecae as in Figs. 58-59 (Worldwide) ... *Leptogaster* Meigen, 1803

(*) Material not available for dissections.

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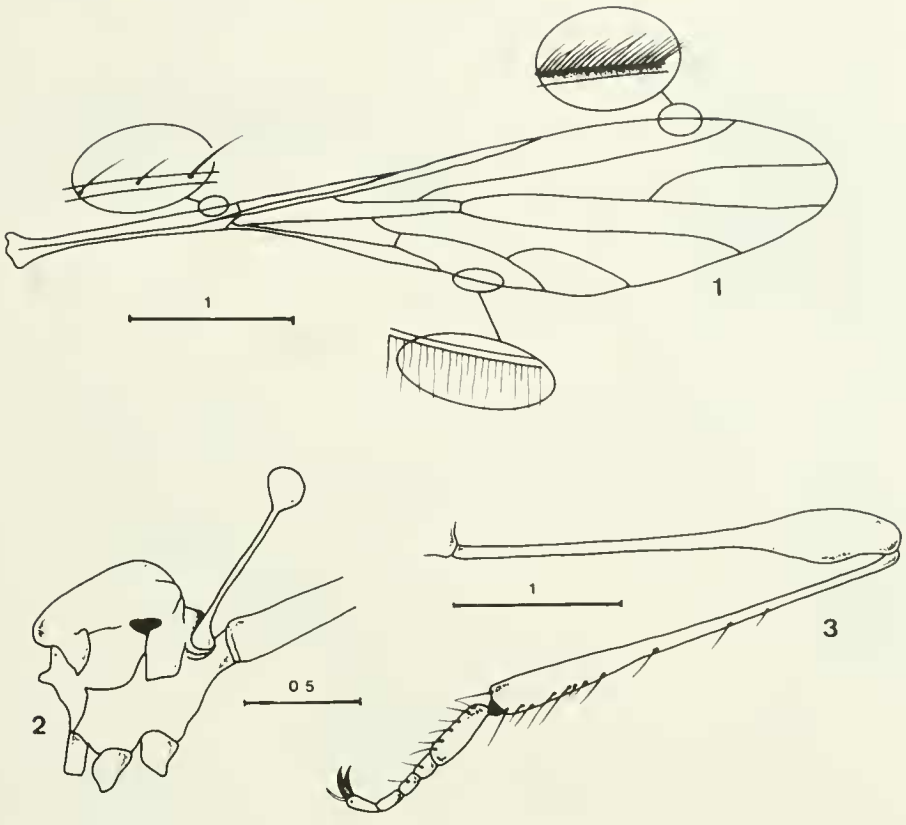
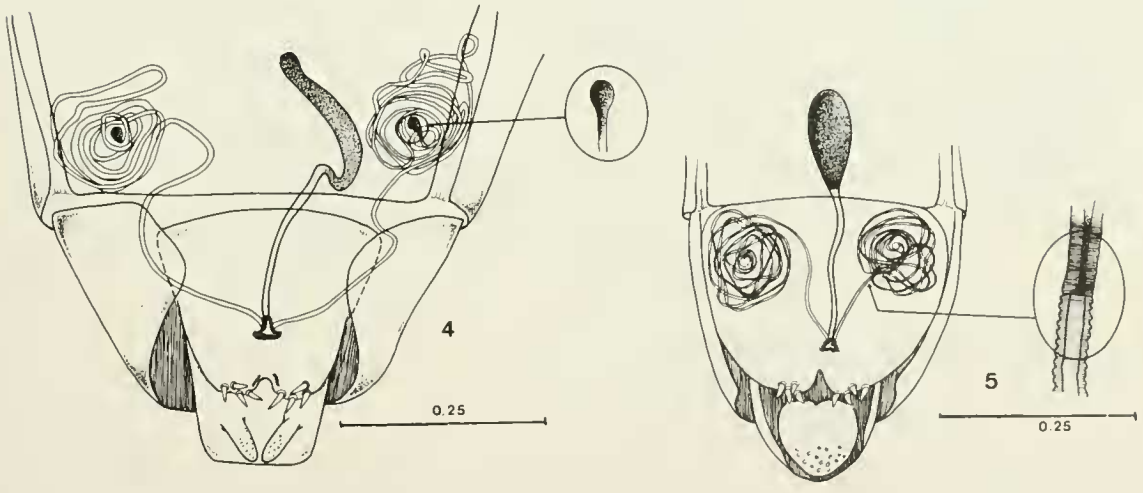
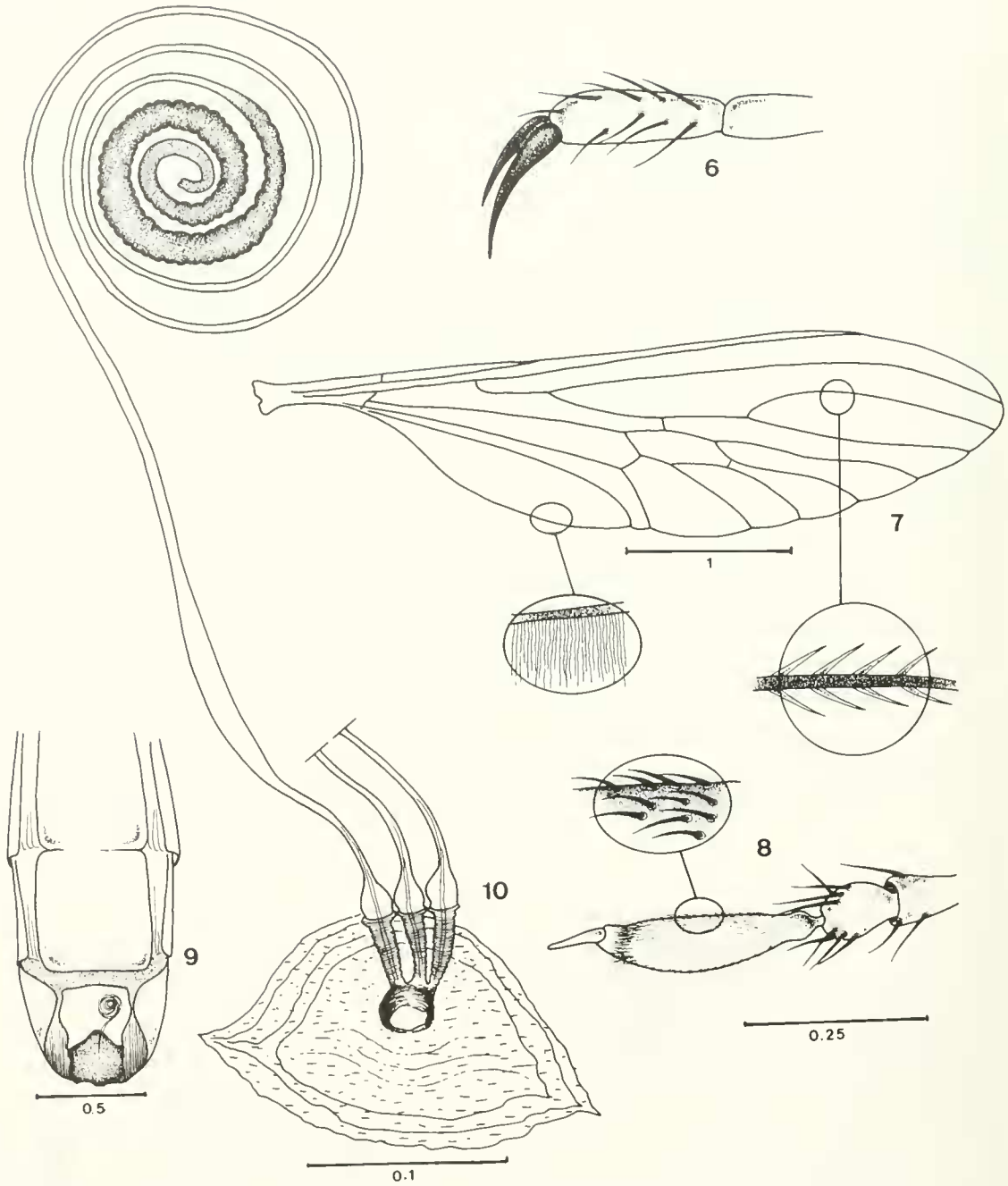


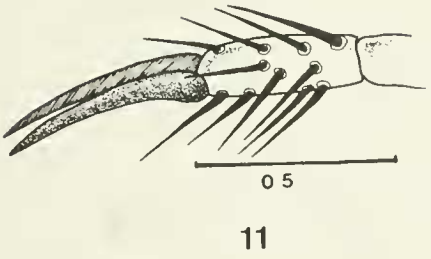

*Leptopteromyia gracilis* Williston: 1. wing; 2 lateral view of thorax, showing elongated halter; 3. hind leg.




Spermathecae of *Leptopteromyia:* 4. *L. gracilis* Williston; 5. *L. americana* D.E. Hardy.




*Schildia fragilis* (Carrera): 6. apical tarsomere showing claws unequal in length and lack of empodium; 7. wing; 8. antenna; 9. situation of the spermathecae in the abdomen; 10. spermathecae.

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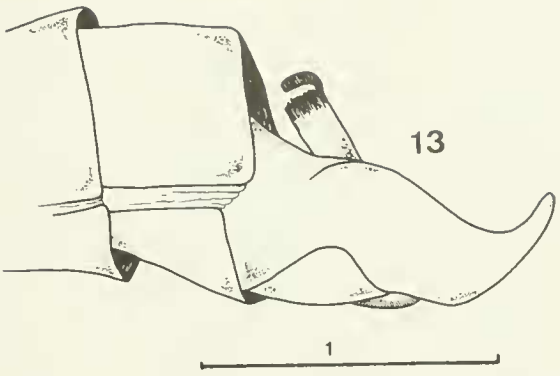
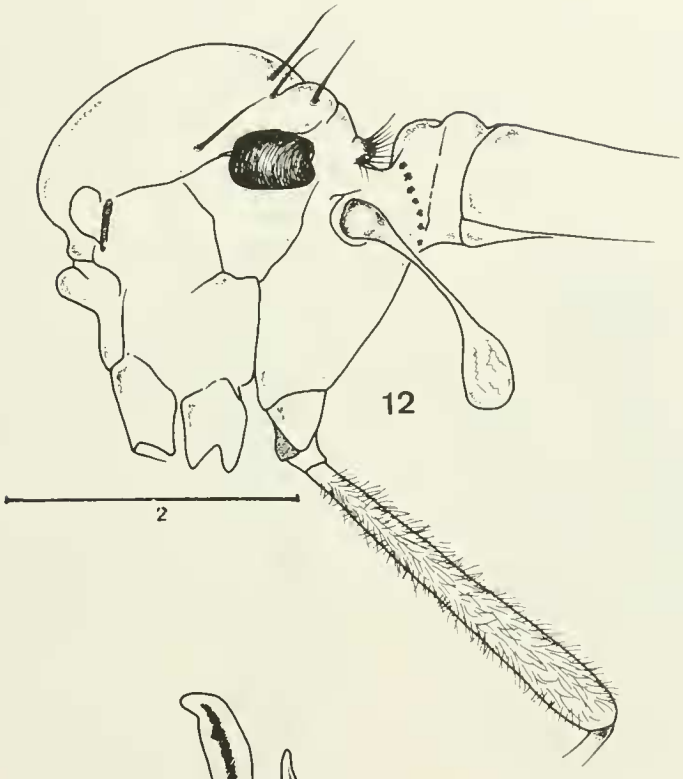
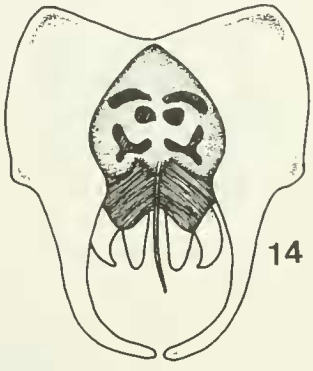
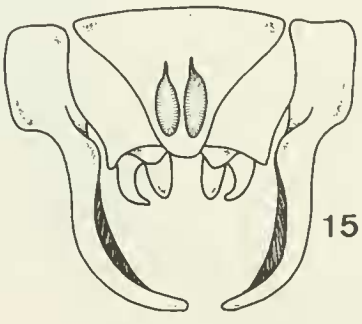
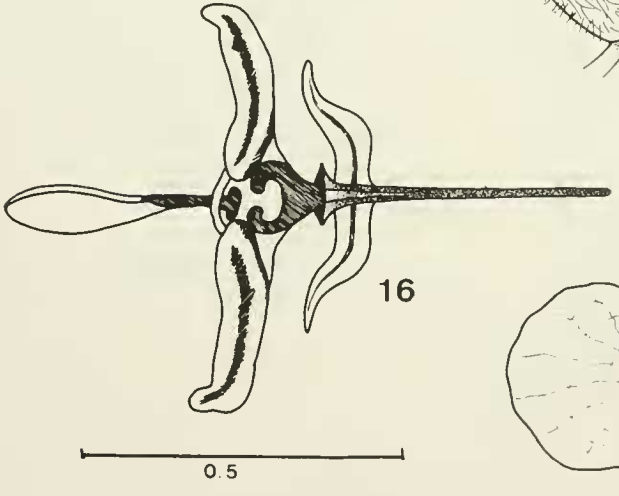


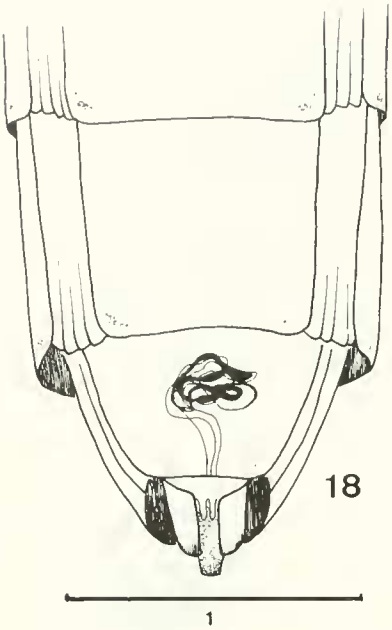



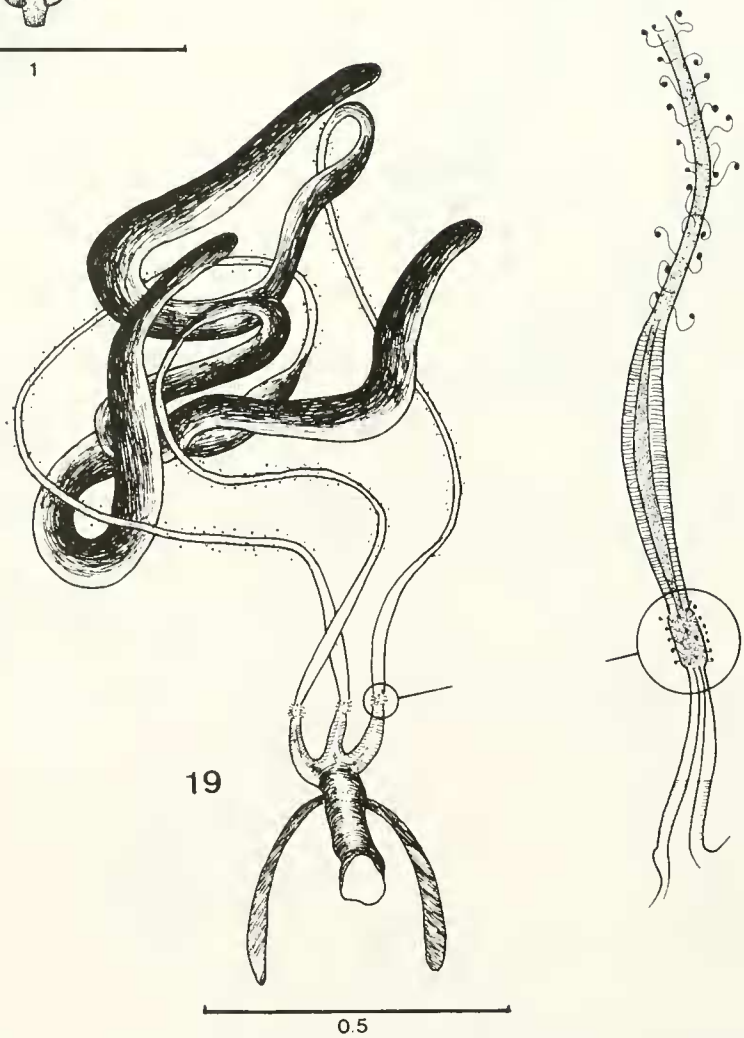



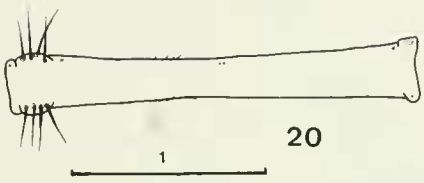


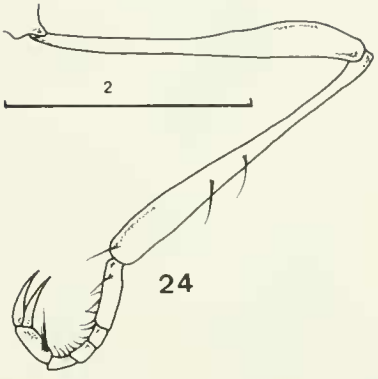
*Systellogaster fascipennus* (Schiner): 11. claws; 12. lateral view of thorax and hind femur; 13-15. male terminalia, lateral (13), dorsal (14) and ventral (15) views; 16-17. aedeagus, dorsal (16) and lateral (17) views.

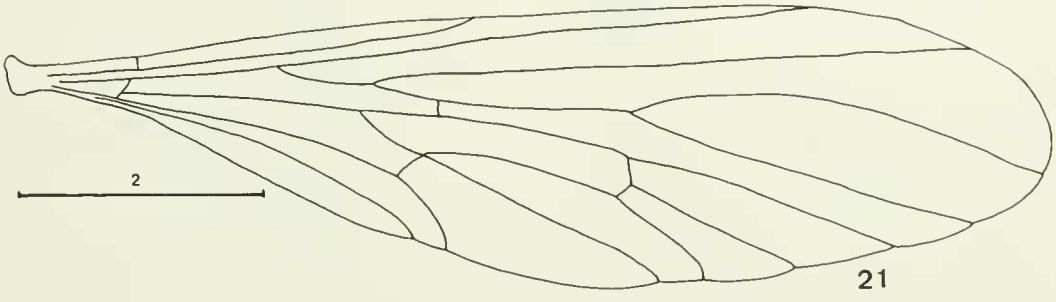


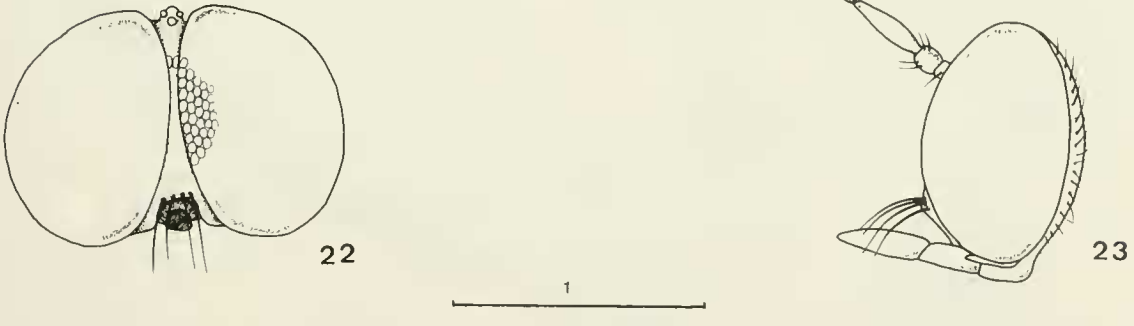




*Systellogaster fascipennis* (Schiner): 18. situation of the spermathecae in the abdomen; 19. spermathecae.

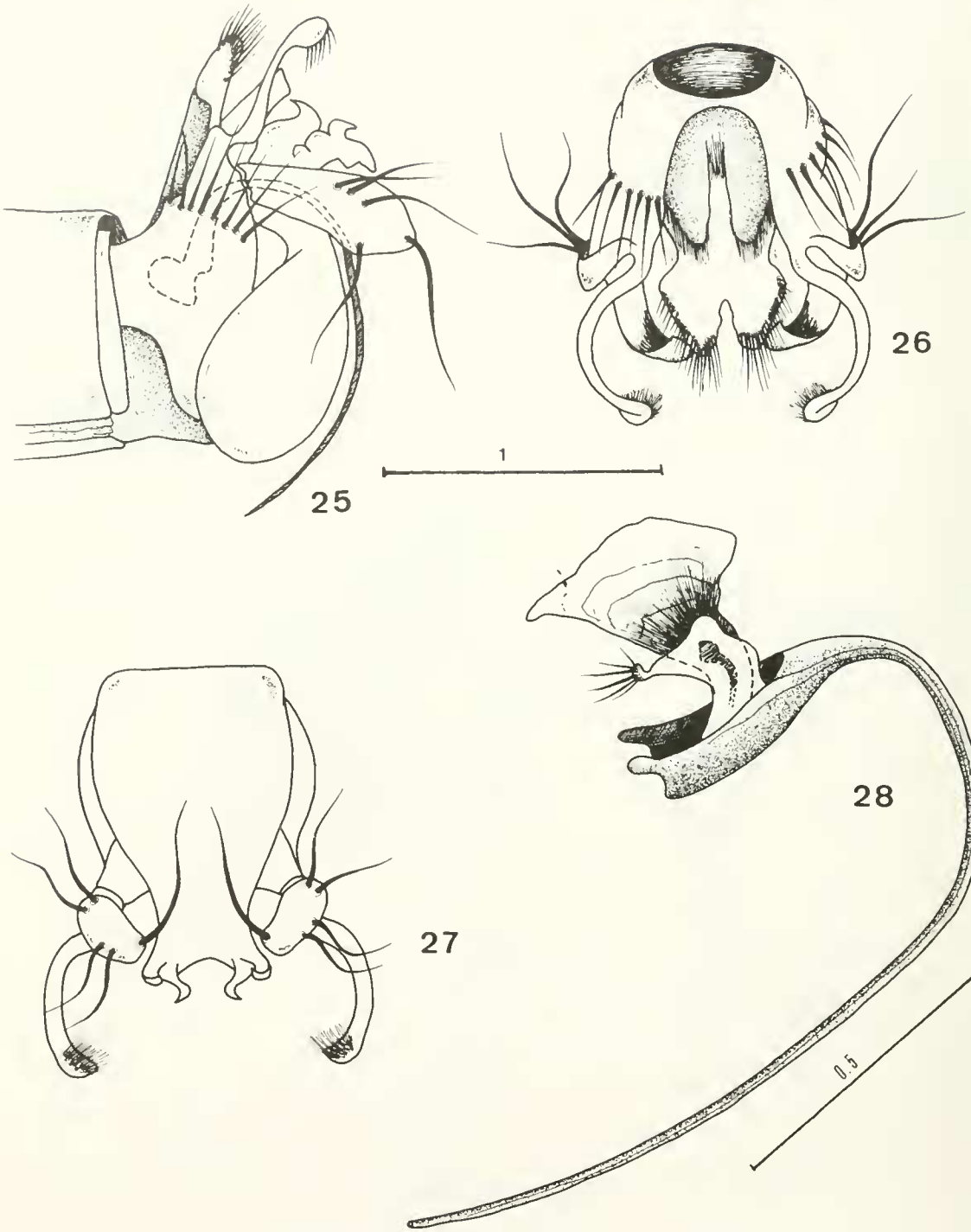


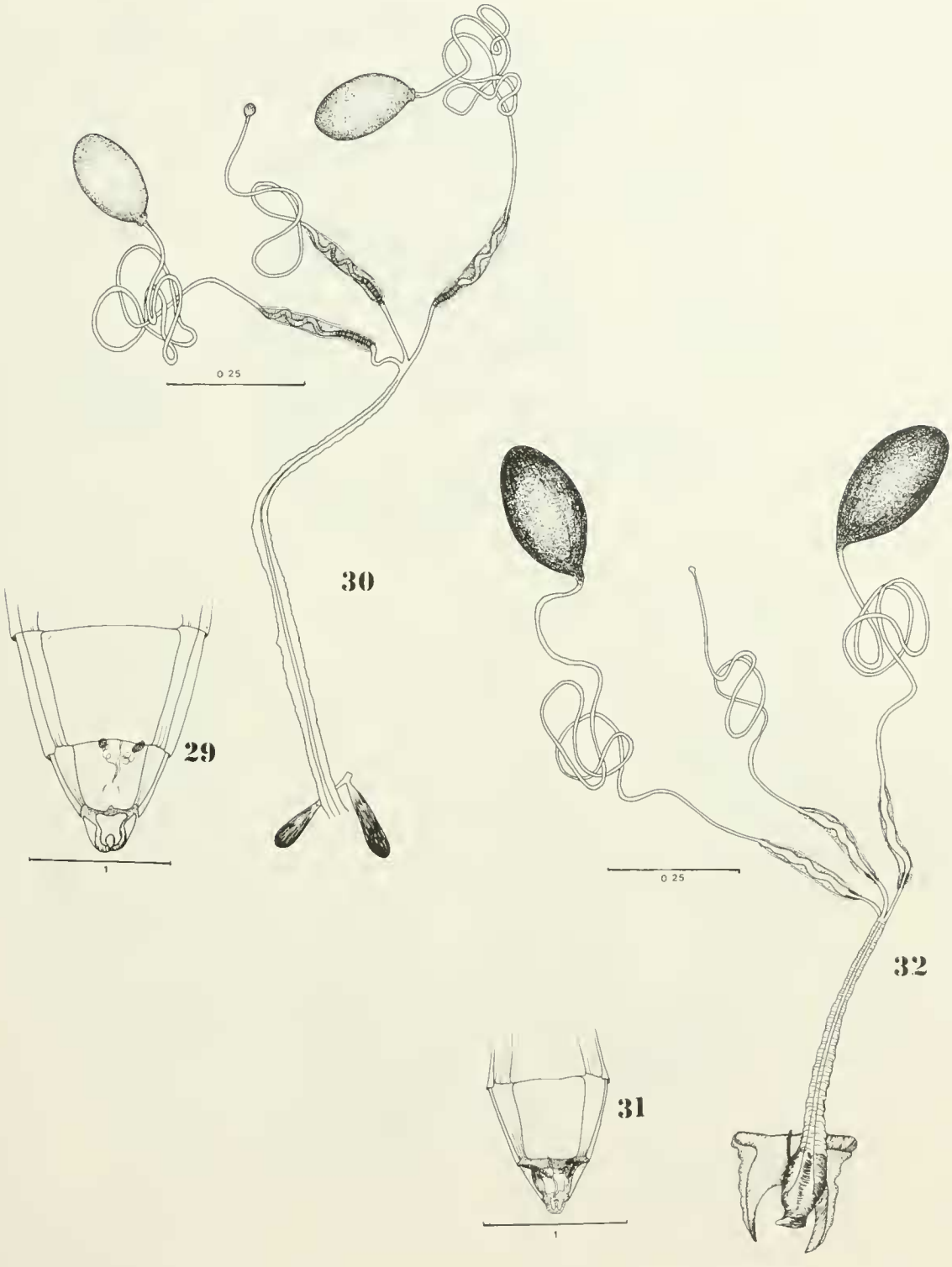



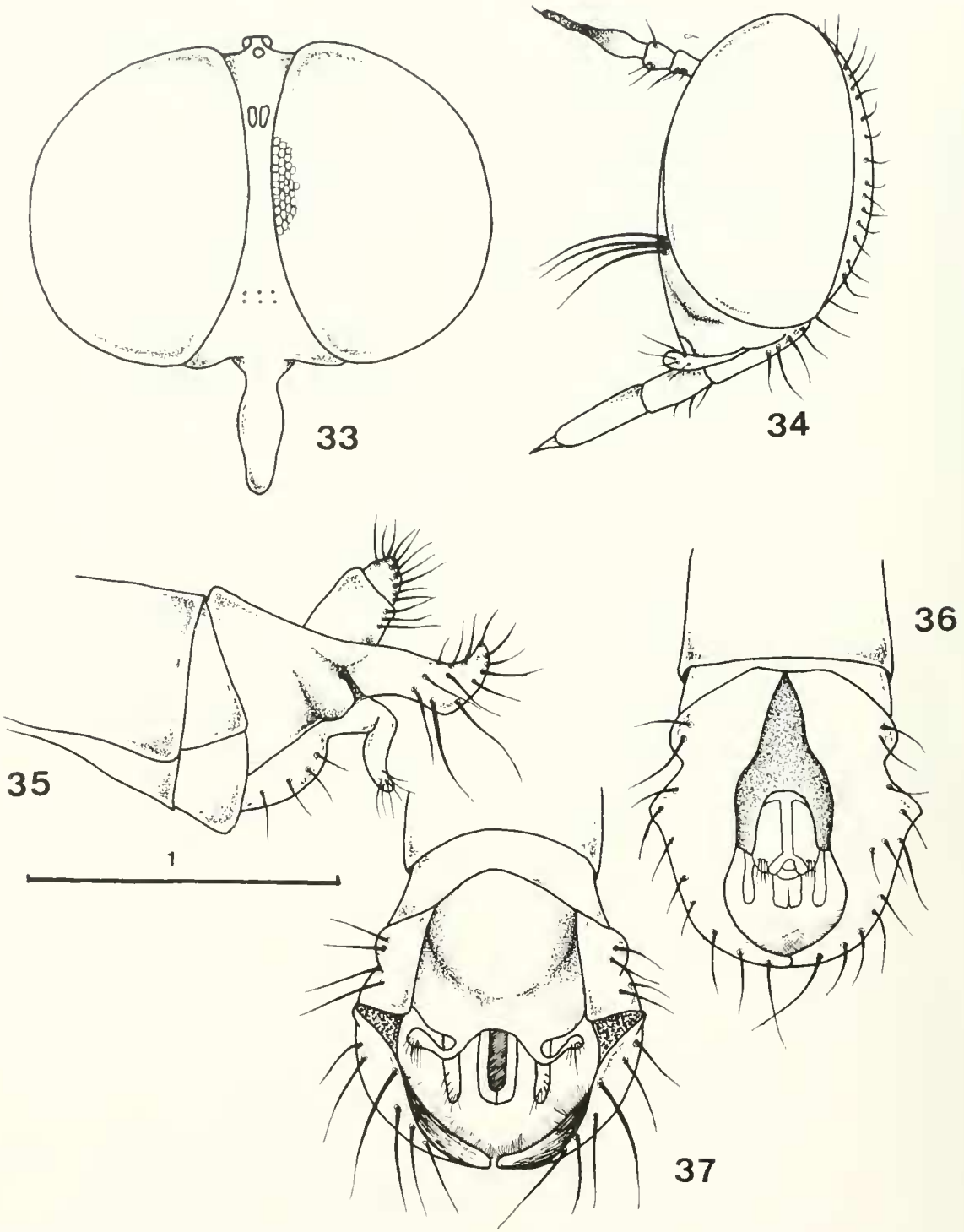

*Psilonyx:* 20. tergite 2 of *P. tornowi* (Brèthes); 24. hind leg of *P. annulatus* (Say); 21. wing of *P. tornowi;* 22-23. head of *P. annulatus* in frontal (22) and lateral (23) views.



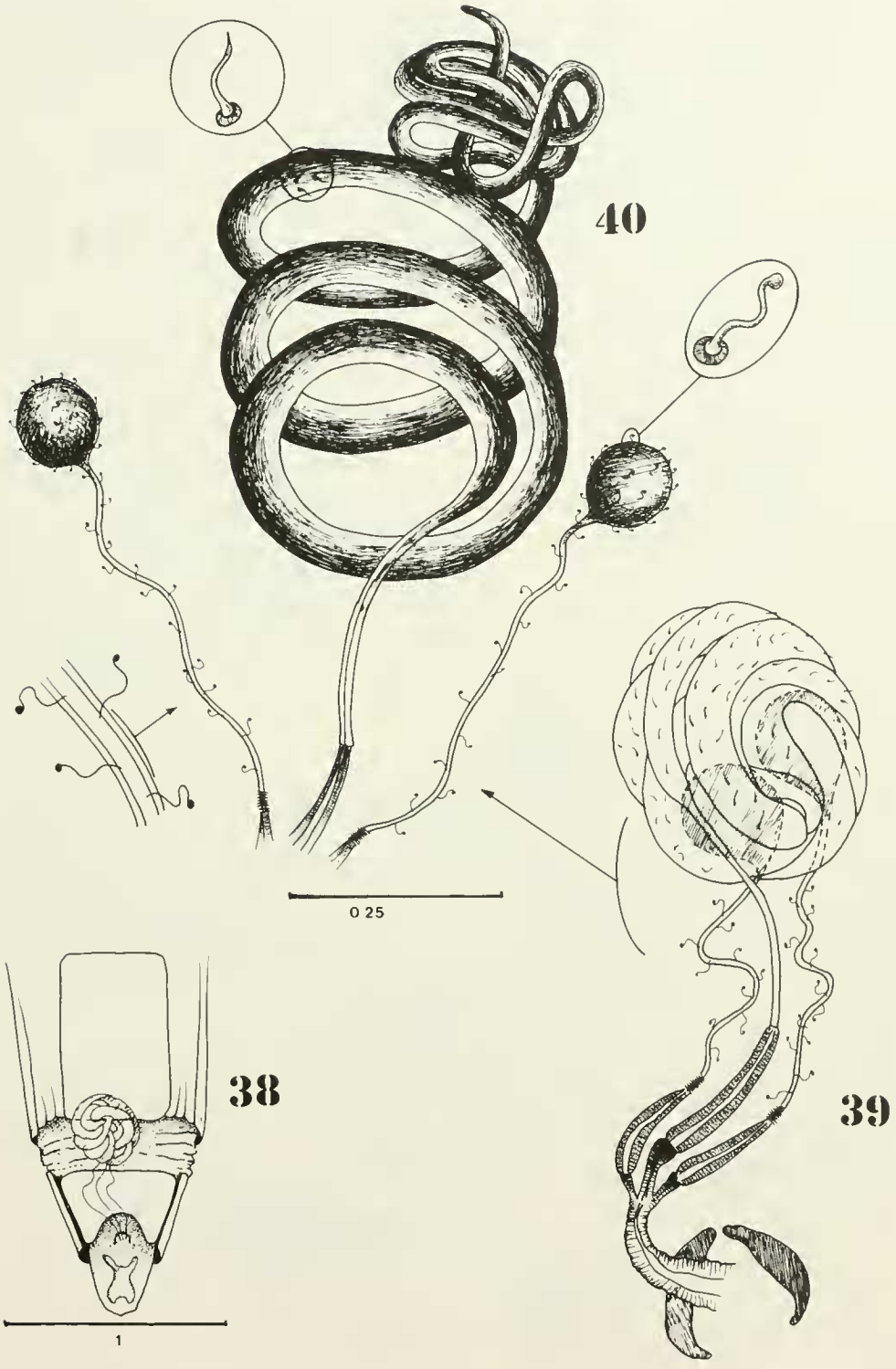

*Psilonyx tornowi* (Brèthes): 25-27. male terminalia in lateral (25), dorsal (26) and ventral (27) views; 28. aedeagus, lateral view.



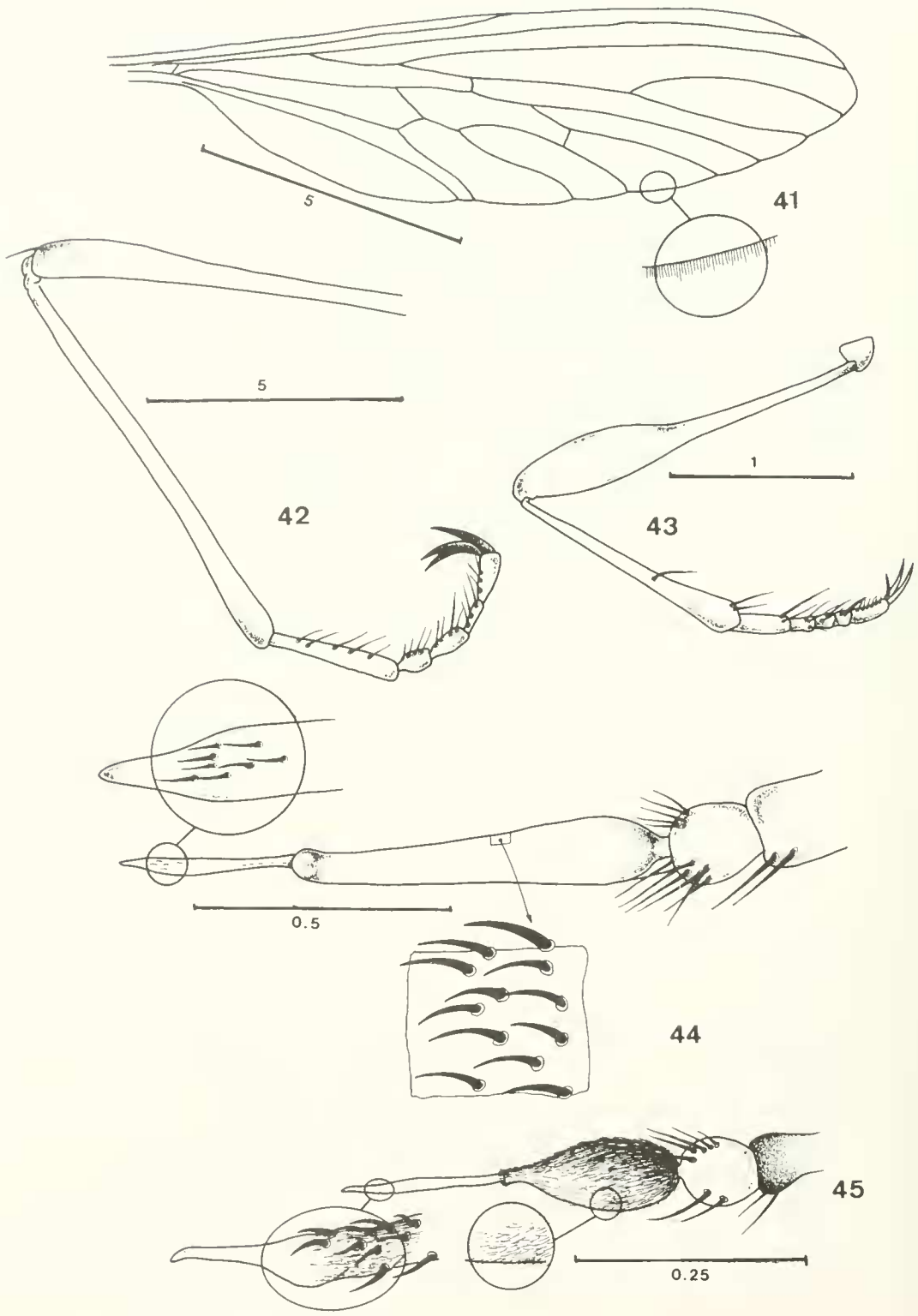

Spermathecae of *Psilonyx:* 29-30. *P. annulatus* (Say); 31-32. *P. tornowii* (Brèthes); 29, 31, situation of the spermathecae in the abdomen; 30, 32. spermathecae.



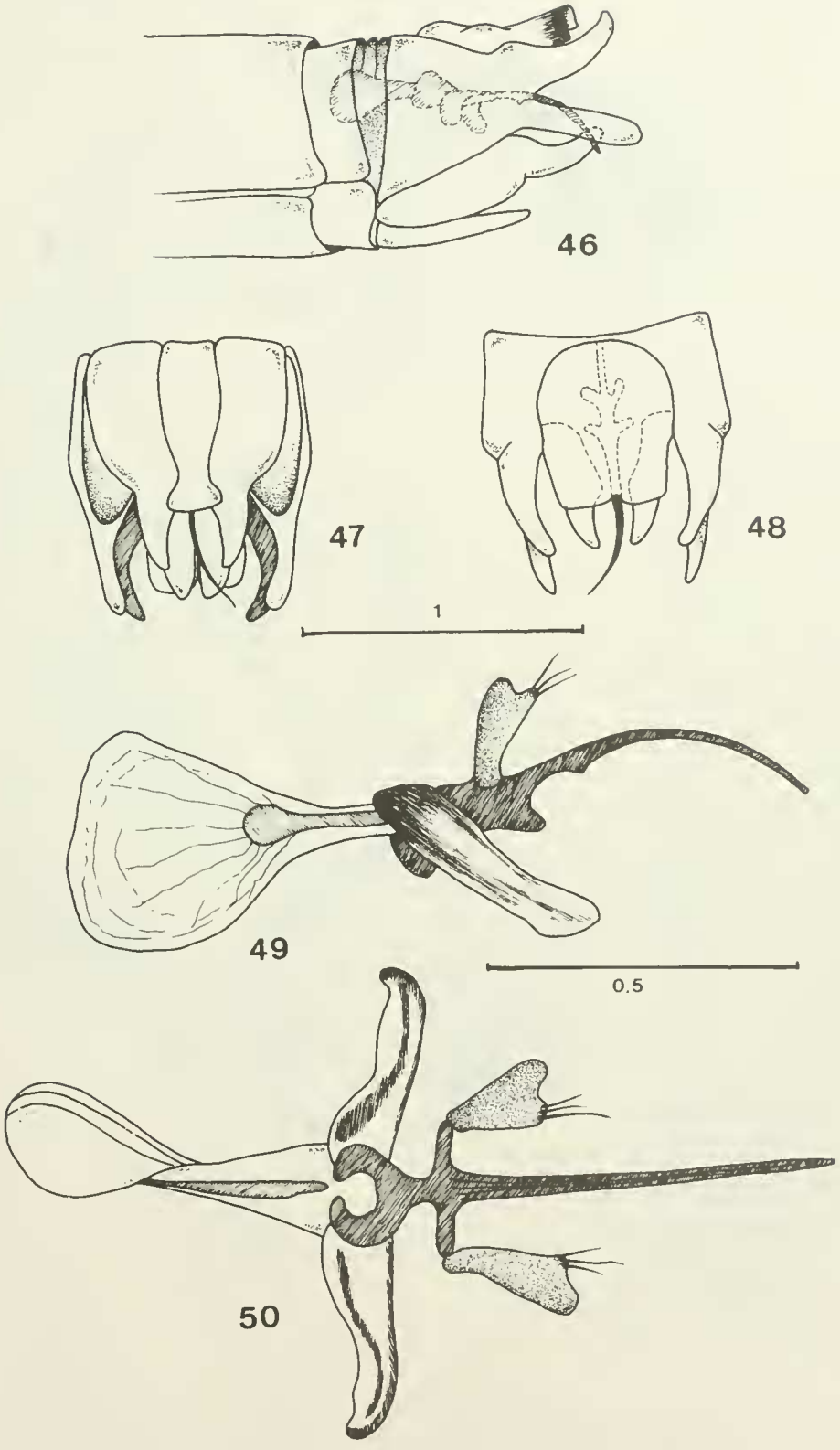

*Beameromyia bifida* (D.E. Hardy): 33-34. head in frontal (33) and lateral (34) views; 35-37, male terminalia in lateral (35), dorsal (36) and ventral (37) views.



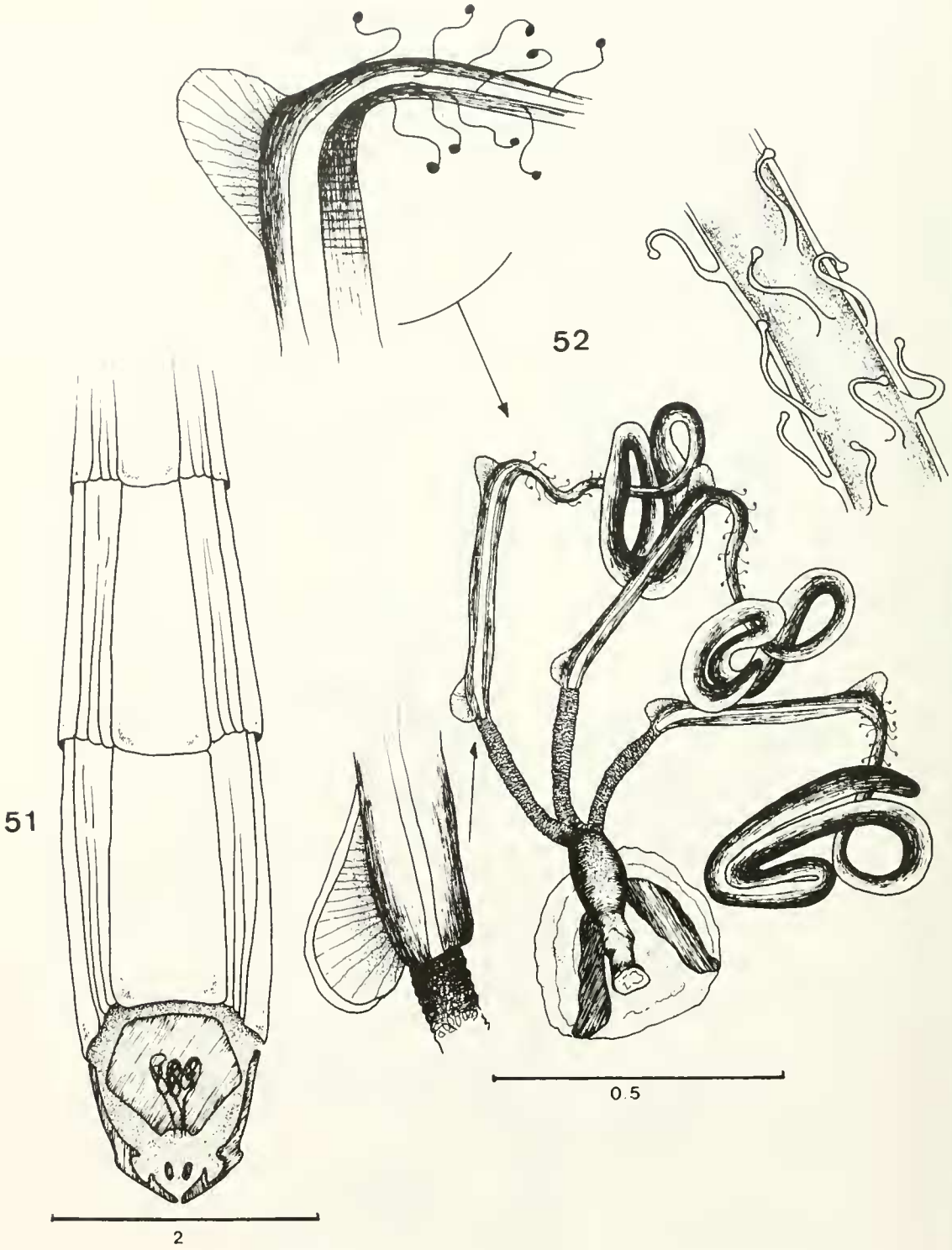

*Beameromyia sp.*: 38. situation of the spermathecae in the abdomen; 39. spermathecae; 40 spermathecae with components separated.



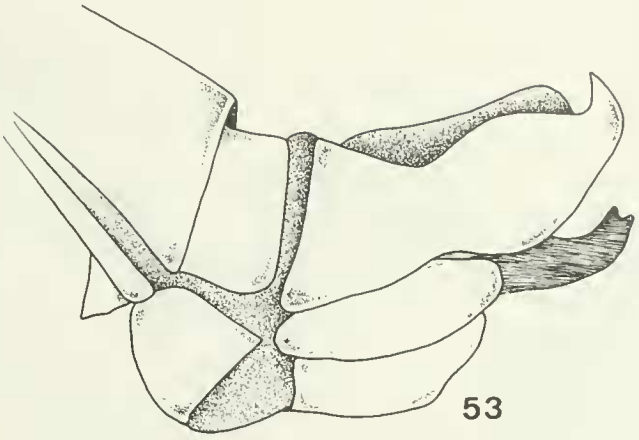

*Tipulogaster titanus* (Carrera), Fig. 41: wing; Fig. 42: hind leg. *Leptogaster cultraventris* Martin, Fig. 43: hind leg. *Tipulogaster titanus* (Carrera), Fig. 44: antenna. *Leptogaster cylindrica* (De Geer), Fig. 45: antenna.

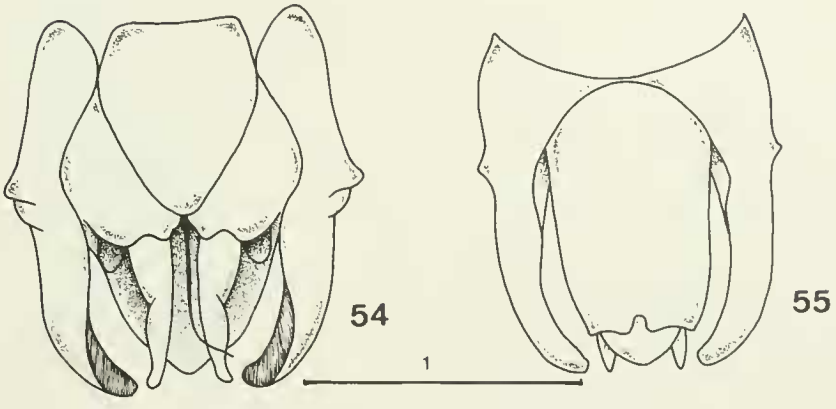


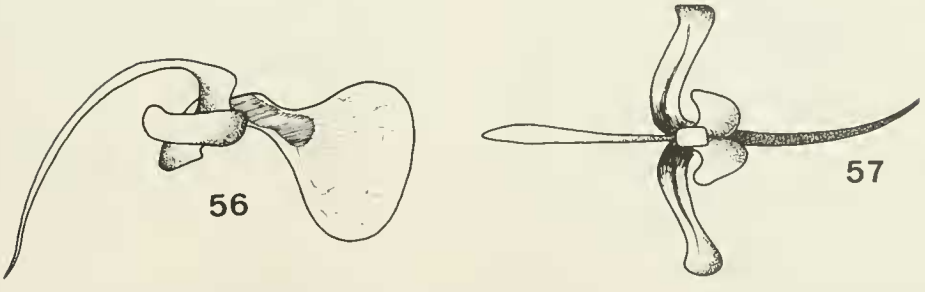

*Tipulogaster glabrata* (Wiedemann): Figs. 46-48: male terminalia in lateral (46), ventral (47) and dorsal (48) views; 49-50, aedeagus in lateral (49) and dorsal (50) views.



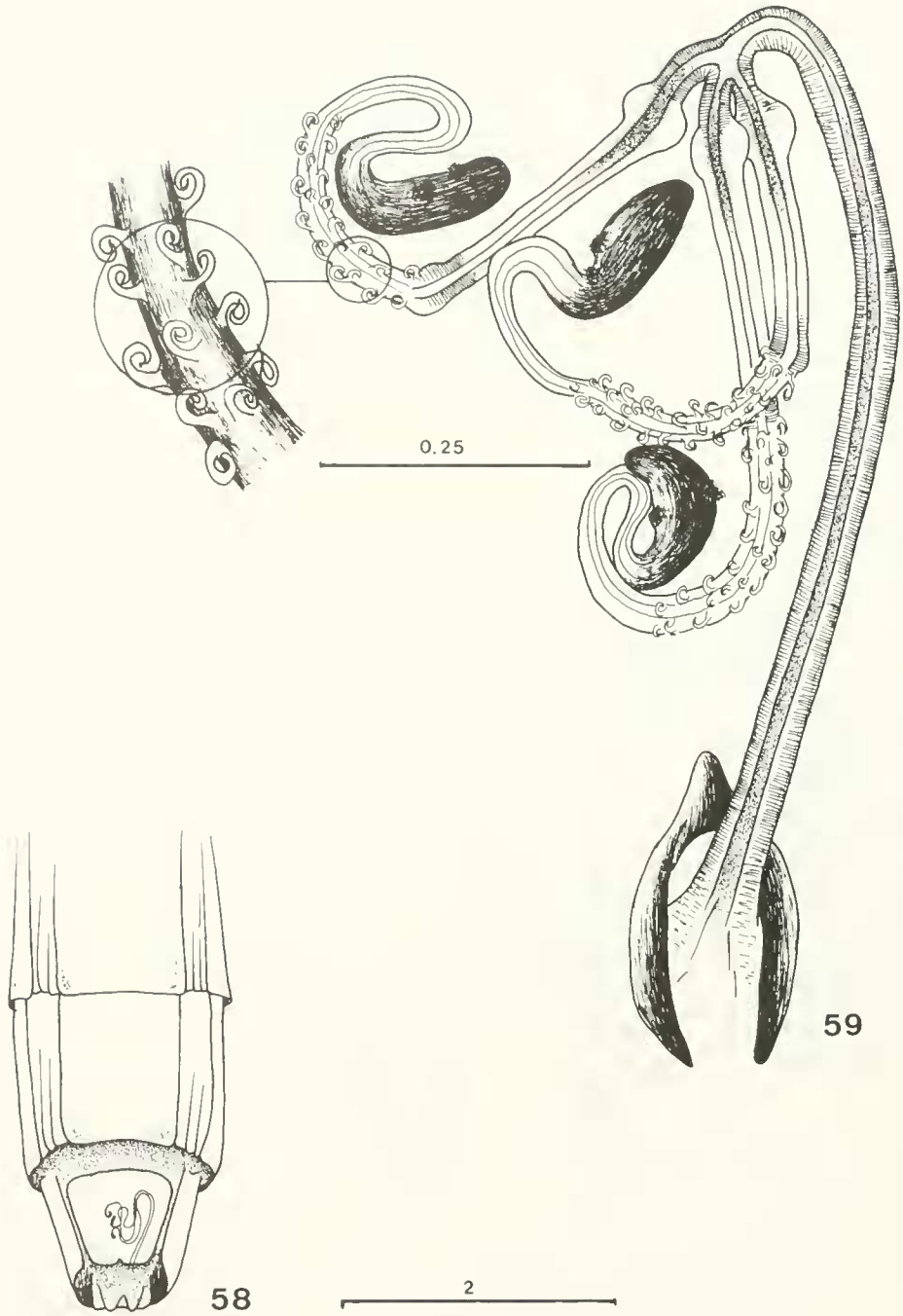

*Tipulogaster titanus* (Carrera), 51: situation of the spermathecae in the abdomen; 52 spermathecae.




*Leptogaster cylindrica* (De Geer): 53-55, male terminalia in lateral (53), ventral (54) and dorsal (55) views; 56-57, aedeagus in lateral (56) and dorsal (57) views.




*Leptogaster? cylindrica* (De Geer): 58, situation of the spermathecae in the abdomen; 59, spermathecae. Our specimens, from Switzerland, "Rheinwald" (Rheinwaldhorn Mts.?), differs in many important aspects from the dissected by Theodor (1980: 263, Fig. 446); they probably represent different species.